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UNIVERSITY BULLETIN
LOUISIANA STATE UNIVERSITY

Published by the Louisiana State University and Agricultural and Mechanical College at Baton Rouge. Issued monthly except November and December.

Entered December 22, 1909, at Baton Rouge, La., as second-class matter, under Act of Congress of July 16, 1894.

VOL. 11—N. S. FEBRUARY, 1911. No. 2.

Farmers' Library

CIRCULAR No. 1

Department of Agricultural Extension,

College of Agriculture,

Louisiana State University, Baton Rouge, La.

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—BY—

V. L. ROY, Director of Agricultural Extension.

Monograph

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Corn Growing in Louisiana.

INTRODUCTION.

Until very recent years the South in general and Louisiana in particular have failed to give corn that measure of consideration and appreciation which it deserves. During many years this crop held third place in Louisiana agriculture; in 1908 it assumed second place, being second only to the sugar crop, and exceeding in value the cotton crop by about $3,000,000; in 1909, corn took first place, surpassing in value the sugar crop by several million dollars, and the cotton crop by $20,000,000.

Since the year 1907, the interest of Louisiana farmers in corn has grown rapidly, and the attention given the crop is increasing year by year. The boys of the corn clubs of the State, numbering 6,037 in 1910, have given time, study and labor to their plots of corn, and have largely contributed to the general interest in the crop. And with the establishment of agricultural departments in Louisiana high schools and the increasing number of pupils taught elementary agriculture in the grades, the educational forces of the State are contributing in large measures to the spreading of information relative to corn.

From farmers, corn club boys, teachers, pupils and the public in general, requests have, therefore, been received for information concerning every phase of corn culture; and it is to supply this need and to respond to this demand, in so far as that may be done through printed matter, that this bulletin is issued.

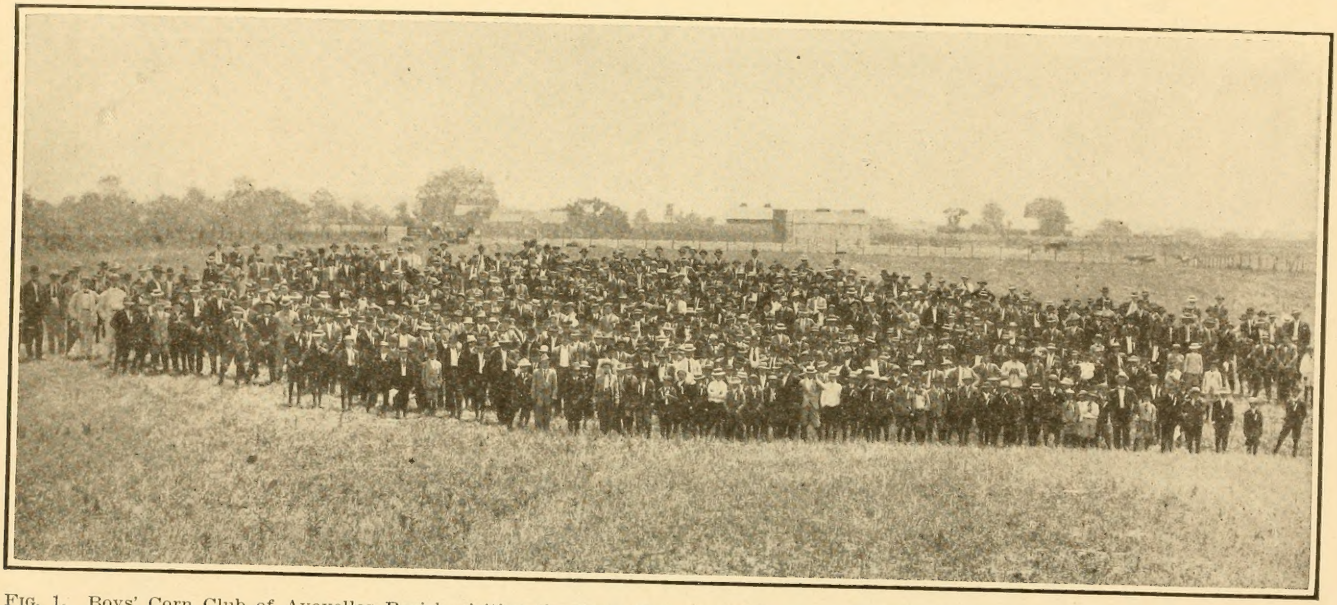

FIG. 1. Boys' Corn Club of Avoyelles Parish visiting the State Experiment Station and College of Agriculture of the Louisiana State University, June 18, 1910.

IMPORTANCE OF THE CORN CROP.

Of all crops grown in the United States, corn is the most important by reason both of its magnitude and money value. It forms the basis of American agriculture, contributing to the wealth of the farmer through its use as an article of human food, as the most largely utilized feeding stuff, and as a sales crop. Corn finds use in the manufacture of scores of products important to our civilization. The acreage devoted to it in the United States exceeds that of any other crop, and its annual money value is greater than that of cotton, wheat and oats. A comparison of the production and value of the three leading crops of the country is interesting. The data in the table following are compiled from the Yearbooks of the U. S. Department of Agriculture.

PRODUCTION AND VALUE OF CORN, WHEAT AND COTTON FOR 1908 AND 1909.

Crop	1908		1909	
	Yield	Value	Yield	Value
Corn, bu.	2,668,651,000	$1,616,145,000	2,772,376,000	$1,652,822,000
Wheat, bu.	664,602,000	616,826,000	737,189,000	730,046,000
Cotton, bales	13,241,799	588,814,828	10,088,000	*706,160,000

*Estimated on the basis of $70 per bale.

For the year 1910, according to the same authority, the production of these crops is as follows:

Corn.....3,121,381,000 bushels.
Wheat..... 631,769,000 bushels.
Cotton..... 11,426,000 bales (estimated).

On a basis of 60 cents per bushel for corn, 80 cents per bushel for wheat, and $70 per bale for cotton, the value of these crops is as follows:

Corn.....$1,872,828,600
Wheat..... 505,415,200
Cotton..... 799,820,000

Not only, however, is corn the most important crop in the country as a whole, but it likewise holds a pre-eminent position in Louisiana agriculture. The statement given below shows the production and value of the crops of corn, cotton and sugar produced in Louisiana for the years 1901 to 1909, inclusive. This data is tabulated from the combined annual reports of the parish assessors to the State Auditor, and from the reports of the U. S. Department of Agriculture.

YIELD AND VALUE OF CORN, COTTON AND SUGAR CROPS OF LOUISIANA FOR 1901 TO 1909.

Year	Corn		Cotton		Sugar	
	Yield bu.	Value	Yield bales	Value	Yield tons, say	Value
1901.....	18,035,322	$13,526,644	880,811	$32,406,798	321,676	$26,709,000
1902.....	16,784,762	11,077,943	882,073	34,982,955	329,227	29,499,000
1903.....	27,937,905	16,203,985	828,186	49,607,420	228,477	18,552,000
1904.....	27,258,443	15,537,313	1,089,526	45,498,605	355,531	37,828,000
1905.....	19,516,499	11,905,064	513,480	27,034,722	336,752	28,287,168
1906.....	26,217,633	15,730,580	987,779	47,650,458	230,000	21,160,000
1907.....	28,000,000	19,600,000	675,428	37,310,642	340,000	28,560,000
1908.....	33,898,000	23,729,000	470,136	20,902,246	355,000	33,800,000
1909.....	51,198,000	35,327,000	253,412	15,400,000	325,000	30,930,000

The total production of corn in Louisiana for the year 1910, as estimated by the U. S. Department of Agriculture, is 58,835,000 bushels, which is an increase of 7,637,000 bushels over the year 1909. The estimated production of the cotton crop of Louisiana for 1910, as reported at the close of the year, is 260,000 bales. If a farm value of 60 cents per bushel is assumed for corn, and the market price of cotton, including seed, is estimated at $80 per bale, the value of our 1910 corn crop exceeds that of our cotton crop by $14,500,000.

YIELDS PER ACRE.

Previous to the year 1907, comparatively little attention was given in Louisiana to the production of corn, and no systematic effort was made to increase the average yield per acre. Hence, we find that it has only been during the years 1908, 1909 and

1910 that the average yield per acre for the State has made any substantial gain over the 10-year average. The following tabulated statement shows the average yield for the United States and for Louisiana during the period from 1898 to 1907, and for the years 1908, 1909 and 1910:

AVERAGE YIELDS PER ACRE OF CORN IN BUSHELS.

	10 years 1898 to 1907	1908	1909	1910
United States	25.6	26.2	25.5	27.4
Louisiana	16.7	19.8	23.0	23.6
Difference	8.9	6.4	2.5	3.8

This shows for Louisiana an increase in yield, over the 10-year average named above, of 18.5 per cent for 1908, 31.7 per cent for 1909, and 41 per cent for 1910; and proves that a slight additional effort on the part of the corn growers of the State could easily bring Louisiana's average yield up to that of the United States.

THE CORN BELT MOVING SOUTHWARD.

Previous to the invasion of the Southland by the Mexican boll weevil, the farmers of this part of the United States devoted practically all their time, labor and land to the production of cotton. Diversification and stock raising were almost wholly neglected. But, today, the changed conditions brought about by the advent of the boll weevil prove on every hand that the South is well adapted to stock raising, by virtue of the abundance and variety of forage crops and pasture grasses that can be grown throughout the year and by the mildness of our winters. It is also capable of producing corn of as fine quality as can be grown in the so-called corn belt, and of producing this crop in as large quantities as any other equal area of the country. Evidence of this is found in the following facts:

That the largest yield of corn ever produced on a single acre (256 bu.) was made in a Southern State; that a member of the boys' corn club of South Carolina produced, in 1910, 228 bushels on one acre; that 28 boys of the Louisiana corn clubs of 1910 grew each more than 100 bushels per acre; that

the average yield of 256 boys who made reports in this State was 61 bushels; that a slight effort on the part of the farmers of Louisiana has, within three years, resulted in an increase in average yield of 41%; and that, of the total increase in the production of corn by the entire country in 1910 over 1909, more than 158,000,000 bushels, or 45%, was grown in nine Southern States. This represents an increase in the farm value of the corn grown in these States of $100,000,000—and this is a part of the United States that has heretofore received practically no recognition as a corn-growing section.

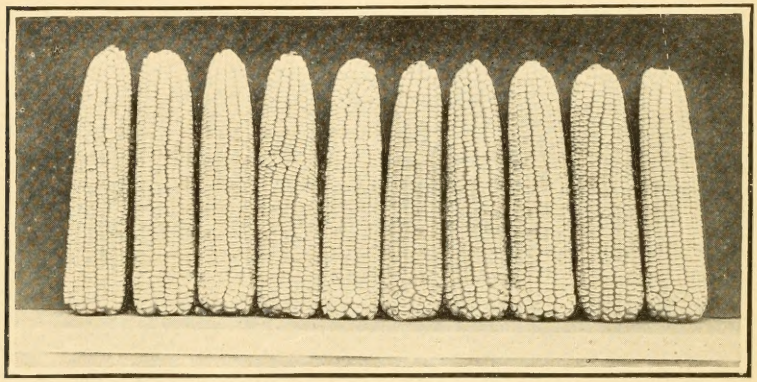

Fig. 2. Mosby Prolific White Dent.

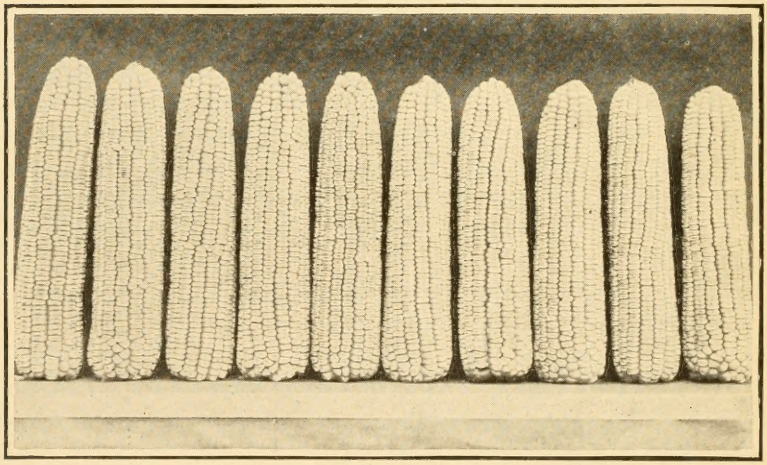

Fig. 3. Gandy Prolific White Dent.

CAUSES OF LOW CORN YIELDS.

A cure can generally be effected when the cause of a disease is thoroughly understood. What, we may ask, are the causes of the comparatively low yield of corn obtaining in Louisiana? Our summers are longer in duration than the corn plant requires to reach full maturity; our rainfall is ample to meet the needs of the plant; and the natural fertility of our soil in all the alluvial lands and in some of the hill sections is as great as that of the lands in the corn-belt. What are the conditions, then, which counteract the good effects of these natural advantages and keep the average of corn production in Louisiana below that of the United States?

Briefly they are as follows, either wholly or in part: Growing cotton, we have in a measure exhausted the fertility of our lands; the humus content of the soil has been drawn upon heavily, and added to seldom and sparingly; the importance of deep fall plowing has been overlooked or ignored; winter cover crops have remained practically unknown; the seed bed has not received the attention it deserves; we have neglected to breed up for yield our native strains of corn; few farmers have selected their seed, and when this has been done it has been in the crib rather than in the field; we have persistently failed to cultivate our corn sufficiently or correctly; and we continue to allow the cockle-bur to grow in our corn fields rather than plant cowpeas or velvet beans. This is a long catalog of agricultural sins, but one justified by existing conditions and practices. It is not meant to imply, however, that there is not a large and increasing number of corn growers in the State who exercise intelligence and employ approved methods in the production of their crops; but rather that the general agricultural practice of the State, in so far as it applies to corn growing, is unsatisfactory and susceptible of vast improvement.

HOW TO INCREASE THE YIELD OF CORN PER ACRE.

The most important means whereby the production of corn per acre can be increased in our State and the points that deserve most attention at the hands of the corn growers, are the following:

(a) Selecting and improving corn land.
(b) Preparation of the seed bed.
(c) Commercial fertilizers for corn.
(d) Seed corn.
(e) Manner of planting.
(f) Cultivation of corn.
(g) Cowpeas on corn land.

Before discussing these points in detail, it should be said that the corn plant consumes a large amount of food; that it requires an unfailing supply of soil moisture in order to grow vigorously and produce grain; that it has a much larger and more extensive root system than is generally thought (Fig. 21); that a shallow soil, plowed three or four inches deep, with a scant supply of plant food and humus, may produce 15 or 20 bushels of corn, but only deep-plowed and thoroughly prepared land containing an abundance of food and humus can yield 40, 50 or more bushels of corn per acre; and that only in such a soil, do we find it possible to store enough moisture to tide over dry spells, and the plant enough space for its root system to develop favorably.

It may be fruitless to speculate upon the results that would follow the general employment of approved methods in corn growing; but there can be no doubt that were such methods practiced in 1911 on all the farms of Louisiana where they are not now used, the production of corn in the State would be doubled. In other words, our 2,250,000 acres devoted to corn would yield more than 100,000,000 bushels; and the annual revenues of Louisiana corn growers would thus be increased by more than $30,000,000. That such a development is entirely possible is firmly believed by practically all the agricultural authorities and leading corn growers of Louisiana.

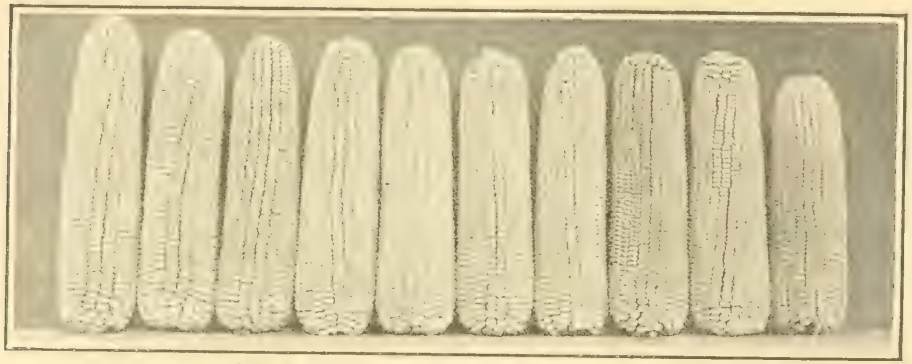

Fig. 4. Sample of Calhoun Red Cob Corn.

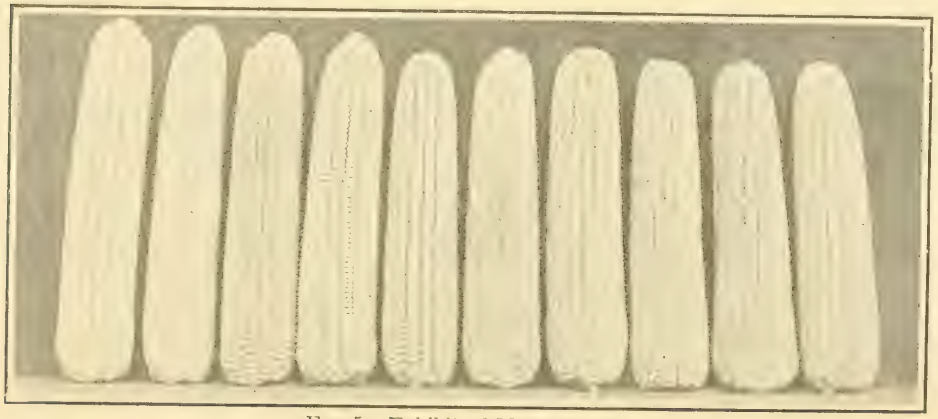

Fig. 5. Exhibit of Munson Corn.

SELECTING AND IMPROVING CORN LAND.

For best results, corn requires a rather light but fertile soil, *well drained,* porous, and containing much humus (decayed vegetable matter). Certain alluvial soils, containing a fair proportion of sand mixed with silt, offer probably the best conditions for corn production; but good corn can be made on nearly all soils of the State. The stiffer clay lands and the sandy hills and flats underlaid with clay, both produce excellent corn when properly handled. For such soils, the most important requirement is a large enough supply of humus, together with *good drainage* in the case of the heavier land.

In the selection of new land for corn, grass sod should always be avoided on account of the many cut-worms usually found on such land.

Much of the land now planted to corn in Louisiana has been more or less exhausted of its fertility by continuous cropping without plowing under green manure crops or barnyard manure. The great need of such soils is more humus.

Humus, as stated above, is vegetable or animal matter in course of decomposition. Before the process of decay sets in or after the process is completed, organic matter, as such, is of practically no benefit to the soil. In a comparatively pure state, humus is found in leaf mold, in well-rotted stable manure, or wherever vegetable matter in mass is decomposing.

Humus is of value to the soil in two respects. Chemically, it contributes nitrogen and other plant foods, and assists in liberating other food held in insoluble form in soil particles. The latter process is accomplished by the action of humic and carbonic acids, which are produced during the process of decomposition; and the former results from the action of different bacteria during the process of decay.

Physically, humus is important in many ways. It improves the texture of all soils; it makes stiff land more friable and fills the open spaces in sandy soil, thus reducing excessive ventilation; it increases the power of clay soils to absorb rain water and retain moisture; it enables sandy soils to hold more moisture, the water-holding power of humus being, pound for pound, about seven times greater than that of sand; it lessens the

amount of moisture lost from soils by evaporation; it makes the average well-drained soil darker, and hence warmer in early spring; it increases the porosity of stiff land, favors root penetration, affords better drainage and promotes bacterial life.

For best results, corn requires a large humus content in the soil. Being a vigorous feeder, this plant, unlike some others, can make profitable use of the rougher forms of organic matter, such, for instance, as green stable manure.

The ordinary sources of humus are threefold. First, it is obtained by plowing under green crops, such as cowpeas, velvet beans, rye, etc.; second, from stable manure spread over the land; and, third, from the droppings of animals pastured in the field where the crops are grown.

PREPARATION OF THE SEED BED FOR CORN.

The time and depth of breaking land for corn, and the management of such land after breaking, depend upon the nature of the soil and subsoil. In general it may be said that one's success in corn growing next year will be measured quite as much, and probably more, by the treatment given the land this year as next year. In other words, the texture of the soil, as affected by the amount of vegetable matter it contains, the drainage of the land and the depth to which the land has been broken the fall previous to planting, determine to a great extent the success of a corn crop.

As a rule, land that is to be planted to corn should be plowed deeply the fall preceding, and as early in the fall as practicable. Failing this, the land should be plowed at the first opportunity, and in every case before January 1st. The only exception to this is in the case of deep sandy soils not underlaid by a clay subsoil. Such lands as this should not be plowed more deeply than five or six inches (depending upon the amount of vegetable matter turned under), and should not be broken in the fall unless a winter cover crop is to be sown. (See page 31.) The reasons for this are obvious.

The stiffer lands, loams, and sandy soils having a clay subsoil a few inches below the surface should be deep-plowed in the fall, unless this would result in excessive washing, as may be

the case on hillsides. Where the slope is not too great, deep plowing frequently prevents washing by enabling the soil to absorb more of the rainfall.

The advantages of fall plowing are found in the following facts: that the vegetable matter on the soil is all turned under and thus changes into humus useful to the next crop; and the

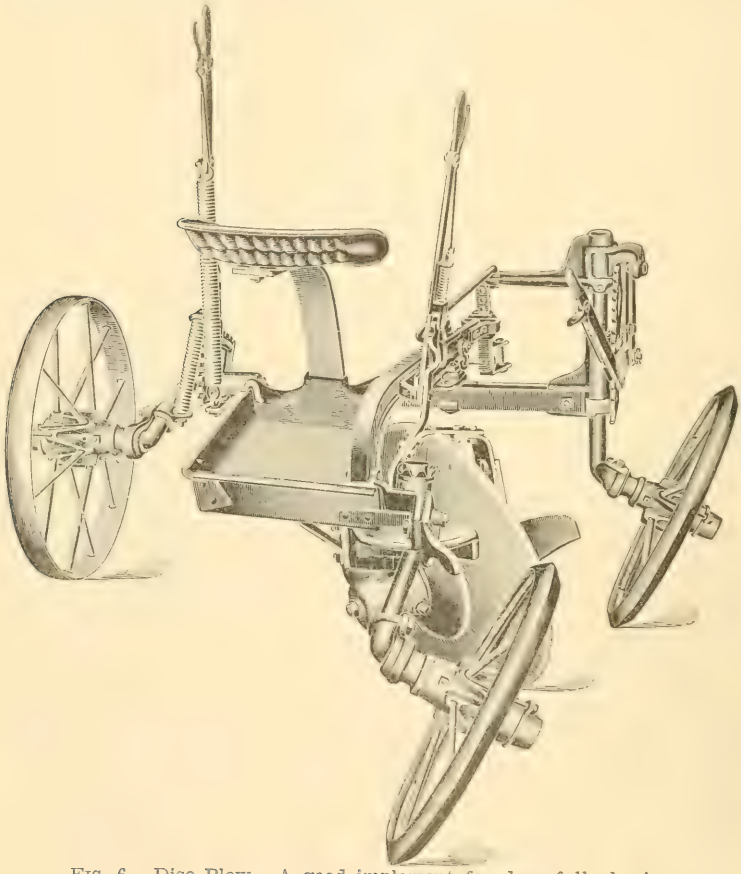

FIG. 6. Disc Plow. A good implement for deep fall plowing.

Acknowledgment is made to the Moline Plow Co. for cuts of implements used in this Bulletin.

lower layers of the soil are turned up and exposed to sun, rain and air; that the soil is opened for the absorption of winter rains; that, through the action of humic acid produced by the vegetable matter, nitric acid washed into the soil, and carbonic acid of the air, plant food is rendered available; and

that insects which are injurious to crops and which are wintering in the soil, are more or less exposed to the rigors of winter weather, and are thus largely destroyed.

Care should be exercised in deepening land by the use of the plow. When the turning or mold-board plow is used, the depth of the furrow should be not more than two inches greater than the depth of the previous plowing; and the form of the mold-board should be such that the furrow will be turned on edge and broken rather than being turned over completely. This method of breaking tends to mix the subsoil more thoroughly with the true soil and prevents a break in the soil, resulting frequently from turning under a heavy growth of vegetation.

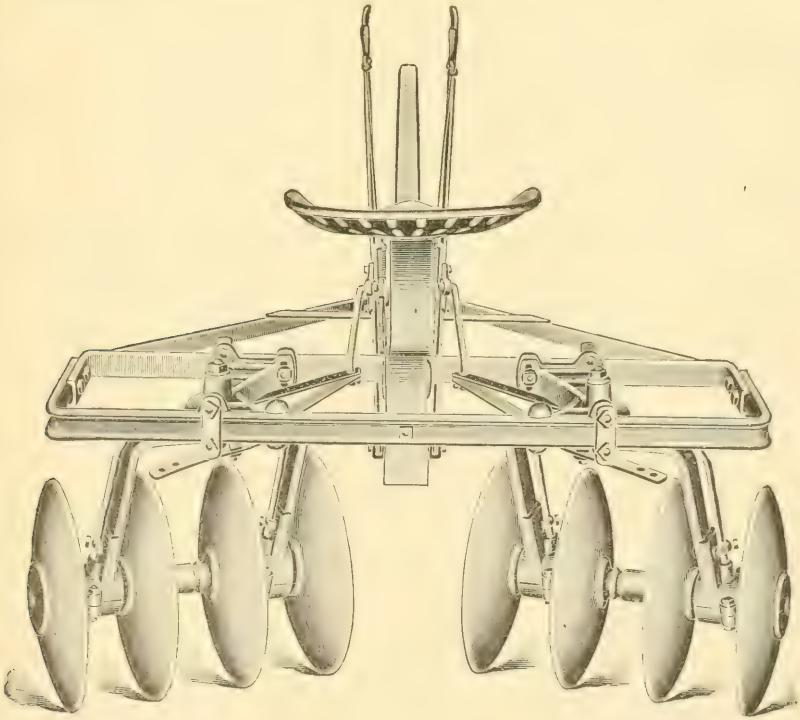

FIG. 7. The reversible disc harrow.

If the fall breaking of corn land is done with the disc plow (Fig. 6), there is no danger of injuring the nature or texture of the soil by plowing at once to a depth several inches greater

than the preceding year. With this implement it is safe to plow 8 or 10 inches if the disc is so adjusted as not to bring too much subsoil to the surface. Gradually, too, as explained above, the soil should be deepened to 8 or 10 inches when the turning plow is used.

After a sufficient depth has been attained with the plow, subsequent breaking should be so regulated as to avoid going to the same depth year after year; for this practice has a tendency to form a hard pan either at less or greater depth.

Fall-plowed land not sown to a winter cover crop should be run over with the disc or spike-tooth harrow, or both, at intervals during the winter, as time and weather conditions permit. This keeps the soil open to air and rain, and results in a more mellow and better seed bed. Cloddy land should be rolled, after which the harrow should again be used to open the soil for the absorption of winter rains.

COMMERCIAL FERTILIZERS FOR CORN.

Of the ten chemical elements used by the plant in building its structure, all but three are always found in soil and air in sufficient quantity and in proper form to meet the needs of crops. These three are potassium (called potash when united to oxygen), phosphorous (usually combined with lime, etc., as acid phosphate), and nitrogen. Lime is also frequently applied to soils to remove the acidity when they are "sour" or to improve their texture.

Potash is used by the plant largely to strengthen the stalk; phosphorus to make and mature the seed and give body to the plant; and nitrogen to produce a vigorous growth of stalk and leaves.

In Louisiana it is not often necessary to add potash to the soil, and seldom profitable to apply it to corn land. Kainit, muriate of potash, and sulphate of potash are common forms of this fertilizer. Wood ashes are also used as a potash fertilizer.

The chief phosphorous fertilizers are obtained from bones or phosphatic rocks, by treating them with sulphuric acid. This process changes the phosphorus compound and renders

it partly soluble, and hence available to plants. This treated rock is called acid phosphate. Raw and steamed bone meal and bone charcoal are phosphatic fertilizers frequently used. Pulverized rock phosphate, made by grinding natural rocks mined in Tennessee and other states, is the cheapest phosphorous fertilizer, the cost of a pound of phosphorus in this form being only about one-half as much as in the form of acid phosphate. Ground rock should be applied at the rate of 1,000 to 2,000 pounds per acre. The initial cost of such application may be considerable, but the effect is far more lasting than where acid phosphate is used. The more finely powdered the rock is, the more quickly do crops profit from its application; and the presence of a large amount of humus in the soil assists in changing the insoluble calcium phosphate of the rock into more soluble forms which the plant roots can use. Frequently ground rock phosphate is composted with manure, whereby also the phosphate is rendered more largely available. Phosphorus is the only plant food that Louisiana corn growers should have to use in the form of commercial fertilizers if their soils have been built up by growing and turning under leguminous crops or by liberal application of stable manure. If phosphorus is applied in the form of acid phosphate, from 100 to 200 pounds per acre should be used, according to the needs of the soil. It should be remembered that the amount of phosphorus, unlike nitrogen, cannot be increased in a given soil by growing leguminous crops; and, therefore, it must be supplied in commercial forms to produce maximum crops.

As stated elsewhere, the best and cheapest source of nitrogen is the air, of which that element forms nearly four-fifths by volume; and the only plants that can make use of the nitrogen in the air are legumes, such as the peas, beans, vetches, clovers, alfalfa, etc. This they do through the bacteria that are found in the wart-like tubercles on their roots. So long, therefore, as cowpeas, velvet beans and other leguminous crops can be easily and abundantly grown in the State, the farmer should depend upon them for his supply of soil nitrogen rather than upon the commercial forms. However, on soils that are naturally poor or that have been worn out by improper methods of cropping, it is generally found profitable to apply nitrogen in the form of commercial fertilizers.

A ton of clover or cowpea hay, when turned under, adds about 40 pounds of nitrogen to the soil, and this is the amount of nitrogen contained in 40 bushels of corn. Five tons of fresh stable manure contain as much nitrogen, phosphorous and potash as is found in 50 bushels of corn. Of the commercial forms of nitrogen, cotton seed meal, which contains 6 to 7 per cent of nitrogen, is the most commonly used. From 200 to 400 pounds per acre are applied, the amount required on a given soil depending largely upon its lack of humus.

Acid phosphate and cotton seed meal are usually applied just previous to planting. They are first thoroughly mixed and applied in the drill either by hand or by means of a fertilizer distributor. A bull-tongue or other suitable implement may follow the distributor, so as to mix the fertilizer with the soil more thoroughly. Some farmers prefer to apply half the fertilizer before planting and half when the corn is 30 to 40 days old. In this case the second application is drilled in on one or both sides of the row.

Nitrate of soda, as a source of nitrogen, is occasionally applied to corn. When this is done, the salt should be used as a top dressing, at the rate of 50 to 100 pounds per acre. about the time of the last cultivation. This practice is of doubtful profit under ordinary conditions.

SEED CORN.

"What seed shall I plant?" and "What seed must I use to increase my yield of corn?" are questions almost invariably asked by the farmer who has awakened to the possibilities of corn growing in Louisiana and who desires to increase his production of that cereal. In fact, while many farmers do not appreciate sufficiently the value of improved seed, others seem to attach too much importance to it. There are many considerations that enter into the production of large yields of corn, and none of these should be deemed unimportant.

The best seed for a given locality is almost invariably seed that has been produced in that locality, or, at least, in approximately the same latitude and under conditions of soil and climate similar to those of the region where the seed is to be planted. Repeated experiments made by Stations in different

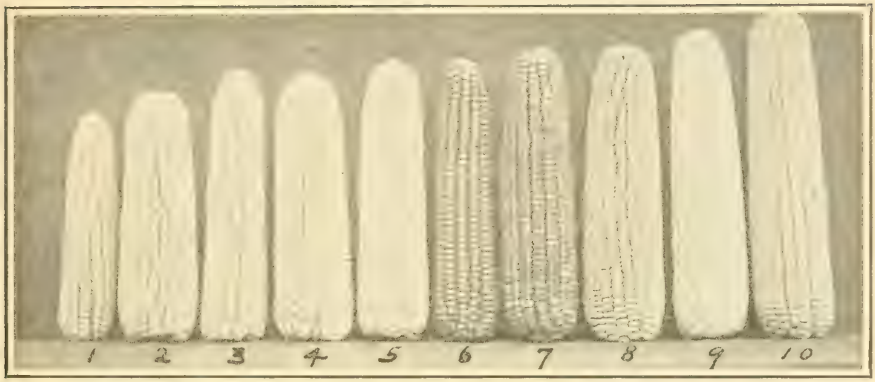

FIG. 8. No. 1, Mosby Prolific. No. 2, Stewart White Dent. No. 3, Gandy. No. 4, Square Deal. No. 5, Royal Semi-flint. No. 6, Yellow Creole. No. 7, Texas Giant Yellow Dent. No. 8, Calhoun Red Cob. No. 9, Munson. No. 10, Shaw.

parts of the country prove that better results follow from the use of locally grown, acclimated seed than from seed brought in from distant states.

The practice of buying Illinois and Iowa corn for use as seed in Louisiana is to be deprecated. However well-bred such corn may be in its native home, it rapidly loses its good qualities when grown in Louisiana. This is due to the change in climate, which it encounters when planted in this State, where the rainfall is greater and the summers are hotter and longer than at the North.

There are many distinct types of corn that have been grown more or less pure in the State for as many as ten to twenty

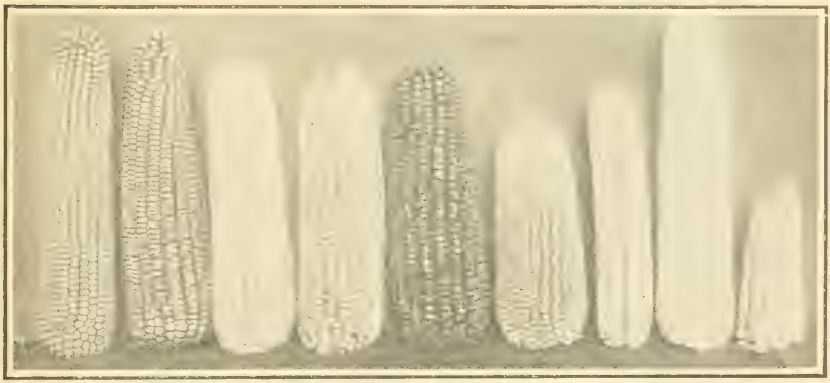

FIG. 9. (Numbering from the left): No. 1, Reid Yellow Dent. No. 2, Strawberry Corn. No. 3, White Wonder. No. 4, cross between White and Red Dents. No. 5, Texas Red Corn. No. 6, Strawberry Shoepeg. No. 7, Hickory King. No. 8, Mexican Flour Corn. No. 9, Pop Corn.

years. These varieties give better results than do such varieties as Leaming, Boone County White, Reid Yellow Dent, and Iowa Silver Mine, which have been bred and grown in the Ohio and upper Mississippi valley. Although these varieties are probably better bred than any corn that has been grown pure in Louisiana for any length of time, yet they deteriorate at once upon being planted in the State.

Of the varieties of corn now grown successfully in Louisiana, and therefore acclimated in the State, the following may be named as some of the more or less distinct types:

Large white dents—Munson, Shaw Improved, Sentell, Gourd Seed, Cahloun Red Cob, Royal Semi-flint (?), Stewart White, Shoepeg, Mexican June.

Prolific white—Gandy, Hastings, Mosby, Blount, Lake End, Bob Hembree, and Hickory King.

Large yellow dents—Gilmer Mammoth, Giant Texas Yellow, Stewart.

Flint variety—Yellow Creole.

Soft corn—Mexican Flour.

It appears to be positively established that greater yields are obtained, under given conditions, by planting the seed of prolific varieties than by the use of that of the large one-eared types. The prolific varieties always yield an average of more than one ear and generally as many as two or more ears to the stalk; and, although the ears of such corn are smaller than those of the large dent types, the average yield per acre is larger because of the greater number of ears produced.

On the other hand, the large-eared varieties, such as Shaw, Munson, Gilmer, etc., require less labor in harvesting and handling, and for that reason are preferred by many farmers. The individual preference of each farmer, therefore, will continue to be, in large measure, a controlling factor in determining what varieties to plant.

Certain prolific varieties have been developed that yield several ears to the stalk, in some instances as many as five or more. The expediency of using such seed is very doubtful. Given a certain amount of plant food, water, air and sunshine, there is a limit to the amount of grain that a corn plant can produce; and it should be remembered that the larger the number of ears produced by a plant, the smaller are the ears;

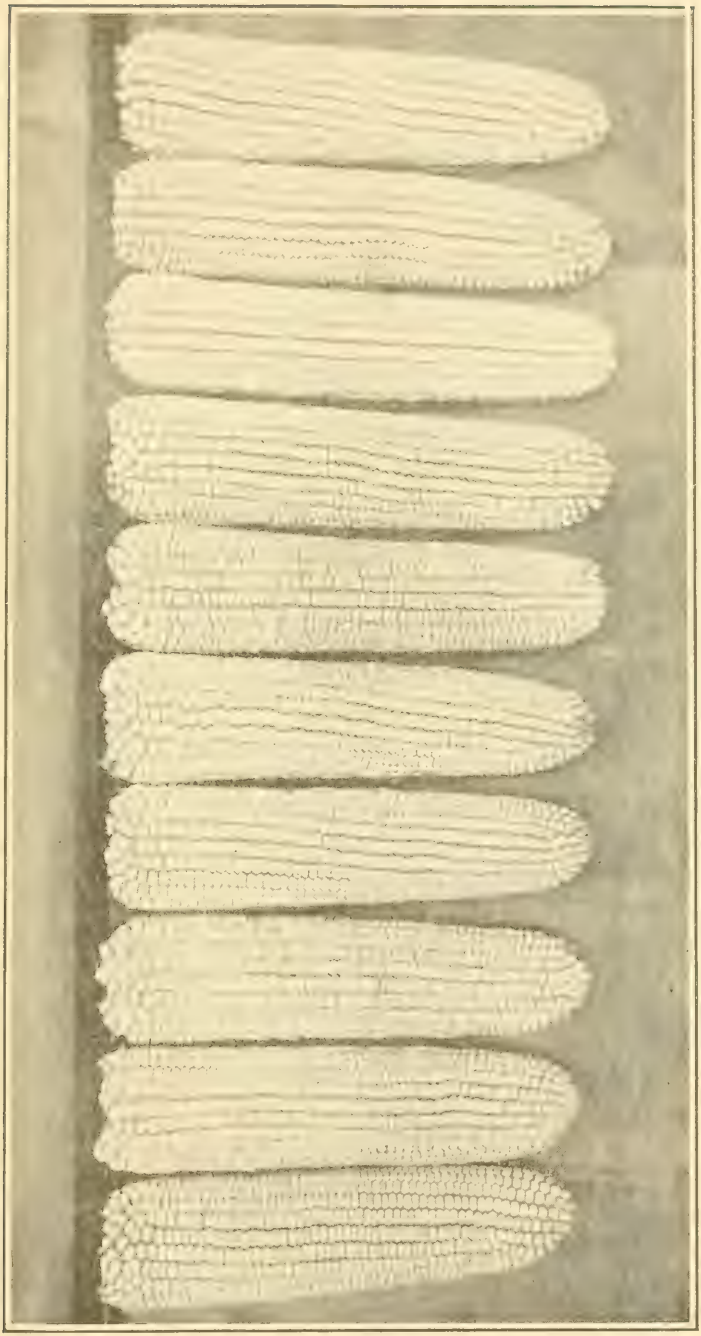

FIG. 10. Royal Semi-flint White Corn.

and the labor of harvesting increases with the number of ears. Besides, the present yield of corn per acre in Louisiana is only the equivalent of an average ear (shelling out 12 ounces of grain) to every six feet in the drill in four-foot rows; and, therefore, it seems somewhat absurd to seek to make three or more ears to the stalk. What is needed is a better stand, a good seed corn that will make an ear to a certainty, and enough plant food and moisture in the soil to ensure the production of one good ear (or two ears in the prolific varieties) on each stalk.

A matter of more consequence probably is that of the hardness or flintiness of the variety grown. In many sections of the State the Yellow Creole (Fig. 8, No. 6) is preferred on account of its flintiness and of its being practically weevil-proof. It should be noted, however, that true flint varieties, such as Yellow Creole, generally have relatively short kernels and rather large cobs; and for that reason the amount of shelled corn produced per acre, when certain poor strains of seed are used, may be less than that of the dent varieties. Better results seem to follow where a cross between Yellow Creole and a large dent variety is used for seed.

In this connection, attention is called to the two semi-flint varieties listed above. The Royal Semi-flint (Fig. 10) is a large-eared, many-rowed, narrow-kerneled white corn; and the Bob Hembree is a hard, white-crowned white corn, from 7 to 8 inches long, but of greater circumference than the other prolific varieties. These two varieties of corn seem worthy of more extensive cultivation, particularly in South Louisiana, where the depredations of the corn weevil are sometimes serious.

Seed corn should always be selected in the field (see pp. 32, 33), or, when purchased, should be bought in the ear (p. 49). For method of testing the germinating power of seed corn, see pp. 50-52.

MANNER OF PLANTING.

Corn is frequently planted too deep. On the average soil, two to three inches is a sufficient depth to cover the seed. It is preferable to drill in the seed 2 inches deep on rather low ridges than 4 inches deep on higher beds. On the lighter and

more friable soils corn may safely be planted deeper than on the heavier and stiffer lands, which are more prone to cake and thus offer resistance to the coming up of the corn.

The average distance apart of corn rows in Louisiana is about five feet. In the northern part of the State and in the prairie sections, corn rows are generally four feet apart; but, on the sugar cane plantations, corn is planted every third or fourth year in the cane rows, which are ordinarily six feet apart. This obviates the necessity of making new rows when the crops change from corn to cane, or *vice versa*. However, ordinarily corn rows should not be more than five feet apart, and four feet is frequently better. A few farmers in the State today check their corn, but this seems practicable only on the well-drained, rolling portions of the State. The alluvial soils and bottom lands are not adapted to that practice, and ridging or bedding seems to be essential to the greatest success.

In deciding upon the width of corn rows, some regard should be had to the variety of corn to be planted. The large-eared, large-stalked varieties require somewhat more space than the small-eared types, which are ordinarily small-stalked. Hence such varieties should ordinarily be planted in wider rows, and somewhat farther apart in the drills.

On account of the larger growth made by corn stalks on rich alluvial and creek bottom lands, it is frequently found to be better to make the corn rows on such land five feet apart. This is the general practice in the alluvial portions of the State.

The size of the plant, depth of soil, and fertility of the land should determine the distance apart of plants in the drill. On a poor soil broken to a depth of only four or five inches, three feet may not be too great a distance between the plants, particularly if the large-eared varieties are sown. On the other hand, fifteen to eighteen inches may be sufficient distance between plants growing on a soil plowed eight to ten inches deep and supplied with an abundance of plant food and humus.

CULTIVATION OF CORN.

Excepting the nature and condition of the soil at planting time, no element that enters into successful corn growing is of as much importance as proper cultivation. The frequency and

method of cultivation determine, to a great extent, the amount of moisture found in the soil during growth and the amount of aeration afforded to the roots, and control the growth and abundance of weeds.

The cultivation of corn should begin by harrowing lightly before the corn comes up, especially if the planting has been followed by a packing rain. The spike-tooth harrow or the section harrow is best adapted to this work. If the ridges are not too high (and they should not be), the harrow may be run either with the rows or diagonally across the field. The corn should again be harrowed a week later, after it is up. This harrowing of the corn may best be done by first taking out the front or middle tooth of the harrow, so as to avoid uprooting the young plants. This preliminary work tends to conserve soil moisture, enables the upper layer of soil to dry out, admits air to the roots, and destroys the first crop of weeds.

From this time on, corn should be cultivated every week or ten days, and as soon after every rain as possible, using always

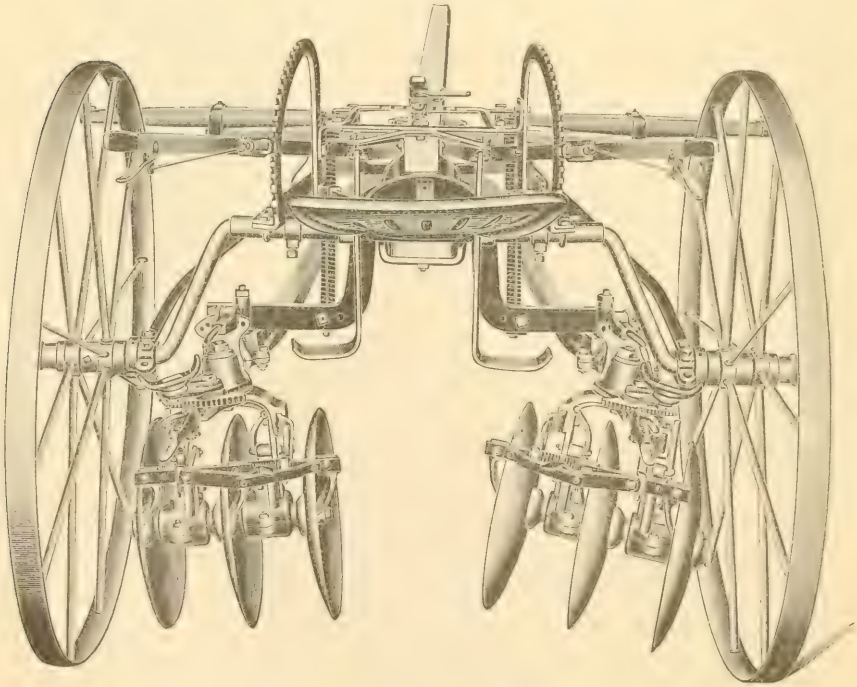

Fig. 11. A foot-guide disc cultivator.

a type of cultivator that will stir the soil only to a depth of about two inches. The disc and various forms of walking cultivators, the acme harrow, the triangular, side and spring tooth harrows (Figs. 11, 12, 13) are implements well adapted to this work, the purpose being always to keep a mulch (or layer of pulverized soil) about two inches deep over the entire field.

Such a mulch is the best means at our command for saving the soil moisture to the crop. The importance of the soil mulch is revealed by an experiment made at one of the experiment stations, in which it was shown that 309.8 pounds of water are required to produce one pound of dry matter in dent corn. If the weight of ear, stalk, leaves, and roots of such a corn plant, when dry, is two pounds, the amount of water taken in by the

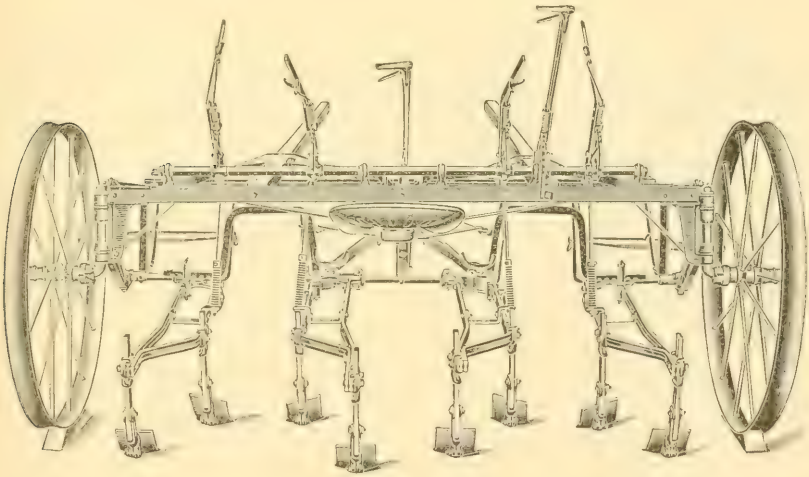

Fig. 12. A good two-row cultivator; saves time and labor.

root system of that plant, together with the evaporation from the surface of the soil it occupies, is nearly 620 pounds (approximately 10 cubic feet). In other words, in such case, if the plants stand 15 inches apart in 4-foot rows, the crop requires for complete growth the equivalent of a 24-inch rainfall. Prof. F. H. King, in his book, The Soil, says: "Two stalks of maize (corn) were growing in each of two cylinders filled with soil, having a depth of 42 and a diameter of 18 inches. These four stalks of corn, as they were coming into tassel and their ears were forming,

used during 13 days 150.6 pounds of water," or at the mean daily rate of nearly three pounds for each stalk. At this rate, an acre of corn grown to a stand with plants 18 inches apart in 4-foot rows, uses 20,885 pounds of water per day; during the last month of the corn's growth the amount of water required by such an acre of corn is more than 600,000 pounds or 300 tons. This estimate leaves out of consideration the moisture that evaporates from the surface of the soil.

Soil that is allowed to pack loses a great deal more moisture through the action of sun and wind than does land covered over with a fine, dry soil mulch two or three inches deep. The reason for this is due to the fact that the untilled soil has very small channels (called capillaries) that run from below entirely up to the surface of the soil. Through these open spaces or channels, the soil water rises as oil does in a lamp wick. Reaching the surface, it is turned into vapor by the heat from the sun and is thus lost to the soil. When, however, such a soil is thoroughly broken and pulverized at the surface, the capillary channels are broken below the surface, and the mulch acts as a blanket over the land, almost completely preventing evaporation from the soil. The dryer and finer the mulch the more effective it is in conserving soil moisture. If a good mulch is left undisturbed for more than a week or ten days, the small channels are gradually restored, and the loss of moisture by evaporation rapidly increases. To be thoroughly effective, the soil mulch should cover the entire surface of the soil.

Beside the formation of the soil mulch and the conservation of soil moisture resulting therefrom, the other great purpose of cultivation is to destroy or prevent the growth of weeds. In this connection, it should be borne in mind that the best time to destroy a weed is immediately after germination and before it has become rooted in the soil. This is best accomplished by frequent shallow cultivation. The use of the hoe to control weed growth is expensive and should be avoided whenever possible. However, during rainy spells, it is generally impossible to give proper cultivation to the corn crop, and weeds and grass make such growth that the use of the hoe is unavoidable. In such case, the corn should be off-barred two inches deep, the corn hoed out, the middles harrowed, a light furrow thrown back to the corn, and the cultivation continued as explained above.

When the rainy season is of long duration, it is sometimes necessary to use the turning plow in order to subdue the growth of grass and weeds. In such cases, less damage results from the use of the plow than when it is used during continued dry weather; in fact, the root pruning resulting from the use of the plow during the rainy seasons may be a slight advantage.

The use of the turning plow in *cultivating* corn is to be condemned in the strongest terms. Except when used to bar off corn preparatory to hoeing or to throw a shallow furrow to the corn when young, the plow should be kept out of the corn field. Not only does it almost invariably damage the roots of

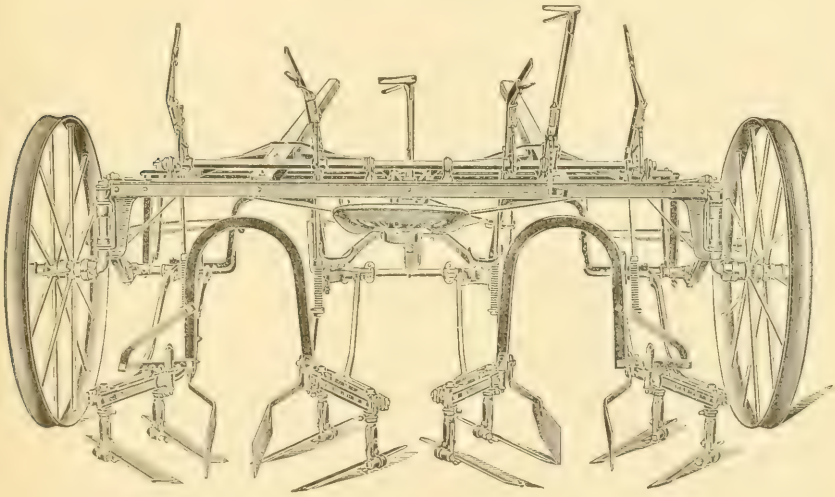

FIG. 13. Implement adapted for shallow cultivation of corn.

the plant, but its use tends to leave out of consideration really useful implements. As is well known, the root system of corn extends to within a very few inches of the surface (Figs. 21 and 22), and when the plow is used for cultivation purposes, it cuts the roots of the corn plants, frequently in untold numbers, thus causing more damage than benefit to the crop. Frequent shallow cultivation and the elimination of the plow alone can be made to increase the corn crop of Louisiana by several million bushels yearly.

The practice of laying-by corn by deep furrows thrown to the ridge from the middle of the rows, is also a source of great

loss to corn growers. It is said that because this laying-by is the last cultivation given the corn, it should be deep and thorough. And, so, the plow is again used, to the great damage of the corn roots, at the very time when the plant is in greatest need of their service in gathering mineral food and moisture. Many farmers believe that it is necessary to build a high ridge at the foot of the plant so as to cover the brace roots; but this view is erroneous, for the brace roots lose their toughness and become tender when covered with soil. If corn has received the proper cultivation, the brace roots will enter the soil in a normal manner, retain their strength, and help materially in holding the plant erect in high winds.

COWPEAS IN CORN.

It is safe to estimate that in 1909 not more than 20 per cent of the corn land in the State was planted to cowpeas or velvet beans. Yet, probably no means is offered to the corn growers of the State whereby the production of corn can be more easily increased than through the use of these two crops sown in corn at the last cultivation. Evidence of this is given in an experiment conducted at the State Experiment Station at Baton Rouge and extending over a period of 18 years.

Thirteen successive crops of corn were grown on a plot without cowpeas. At the end of that period, five years ago, the plot was divided into two parts. On the first, corn has continued to be grown without cowpeas, and the yield per acre in 1910 was 18.6 bushels. On the second plot, an application of stable manure was made five years ago, since which time corn and cowpeas have been grown annually, with the exception of one year, when cotton was grown. This plot of corn yielded in 1910 at the rate of 63 bushels per acre, or 3 2/5 times as much as the first plot did. Practically all this increase is to be credited to the plant food and humus and the improvement in soil texture due to the four crops of cowpeas and one crop of clover turned under.

Cowpeas may be broadcasted in the middles of corn rows and covered with the plow two inches deep or drilled in with the planter at a convenient distance from the plants at the last

cultivation. The sowing should be at the rate of a bushel to a bushel and a quarter per acre. Velvet beans, which make a heavier and thicker growth, are planted as cowpeas are, at the rate of 2 pecks per acre.

A common economic error is made in planting cowpeas by using varieties that do not seed in the locality where grown. Every corn grower should, by trial, ascertain which variety is best suited to his condition—that is, which variety gives the heaviest growth and at the same time produces seed; and he should then use this seed for his crops. The chief reason why cowpeas are not sown more regularly in corn and for forage and green manure purposes, is that few farmers gather at harvest time a sufficient supply for planting the next year's crop. The best varieties for use in Louisiana appear to be the Whippoorwill or Speckled, the Iron, the New Era, and the Unknown.

The value of sowing cowpeas or other leguminous crops in corn arises from the amount of nitrogen gathered from the air through the bacteria found on the roots of the plant and from the amount of humus derived by the soil when the crop is turned under, or pastured, or fed to stock and the droppings returned to the land. Two-thirds of the nitrogen, worth from 20 to 25 cents per pound, found in the cowpea plant, are obtained from the air at practically no cost to the farmer. The idea generally prevails that the soil derives as much fertility from a crop of cowpeas when it is fed to stock and the manure returned to the land, as when it is plowed under. This is erroneous. During the process of digestion, the animal consumes about one-fourth of the nitrogen and two-thirds of the organic matter which would produce humus.

HARVESTING AND STORING CORN.

In the so-called corn belt, much of the corn is harvested in the following manner: the stalks are cut near the ground and placed in shocks, where the ears finally dry out. The ears are then husked and hauled to bins. The stalks, husks and leaves are then used as corn stover. On account of our abundant rainfall, particularly in the southern half of the State, it appears to be unprofitable to attempt to save corn stover as is done at the North. Experiments made by the Louisiana Stations indicate

that, unless the fall season is dry, shocking corn with a view to saving the corn stover seems impracticable.

The practice of pulling corn fodder, once very general in the State, but now less frequent, is unwise. The labor involved, the injury done to the grain crop, and the small amount of forage obtained, all argue against the practice. The same labor given to harvesting hay is far more profitable.

In one respect our system of harvesting corn seems to be at fault. When corn is gathered in the ear, practically all corn weevils in the field are collected and safely placed in the crib or bin. There they multiply rapidly, consume the grain, and render the remaining corn less fit for feeding or planting purposes. In sections where the weevil and other grain insects are found in sufficient numbers to warrant it, it would seem wise to husk the corn as it is gathered in the field, store it in ceiled bins, and poison the pests with carbon bisulphide. This plan would have the added advantage of leaving in the field or wagon very many of the insects that would otherwise find their way into the corn bin.

A suitable bin for this purpose may be made by covering all sides, floor and ceiling, with tongue-and-groove ceiling or flooring, or shiplap may be used and covered on the inside with thick paper or some of the new composition roofings. All edges and corners should be covered with 6 to 10 inch strips of galvanized iron as a protection against rats and mice. The shutters and door should be of ceiling and so put in as to be made air-tight when closed. If, after the corn is stored, weevils or other insects cause damage, they should be poisoned with carbon bisulphide, commonly called "high life." The poison should be placed in shallow vessels, at the rate of a pint (or pound) per 100 bushels, and set *above* the corn. The shutters and door should then be closed tightly, and the bin left undisturbed for 24 to 48 hours. At the end of this time, practically all weevils will be dead if the bin is air-tight. Care should be taken not to have a flame near the poison, as the vapor is exceedingly explosive. The carbon bisulphide will destroy not only all insects in corn, but rats and mice which are unable to escape; and, if used as directed above, will not injure the germinating power of the corn. Carbon bisulphide should not cost more than 15 cents per pound or pint.

WINTER COVER CROPS ON CORN LAND.

Due to the earliness of the corn-planting season in Louisiana (the average for the State being about March 4), few crops suited as winter cover reach such maturity that they can be economically harvested. That, in a measure, accounts for the very general failure to plant such crops. Yet, there can be no doubt of the profit to be derived from certain winter-growing crops when used either as green manuring (turned under) or for

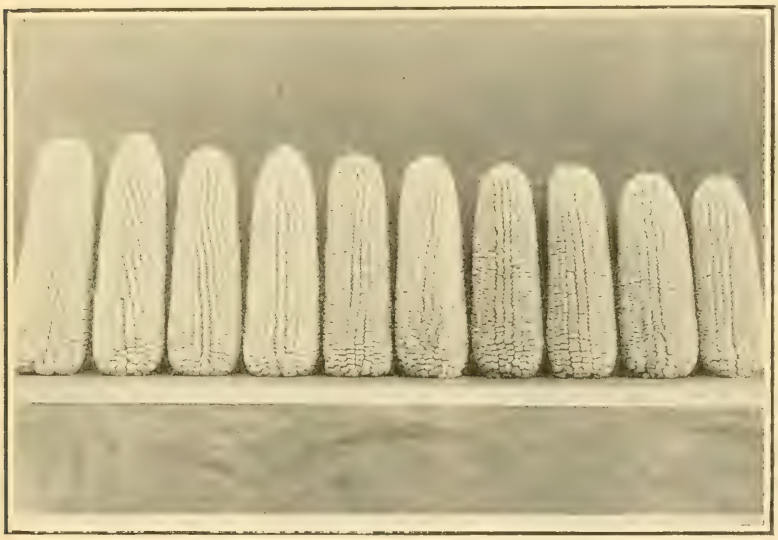

FIG. 14. Stewart White Dent.

grazing purposes. In proof of this statement we may cite an experiment made at the Louisiana Experiment Station, where hogs and lambs were pastured on fall-sown oats. The gain in weight of the animals pastured during the experiment, on the basis of 6 cents per pound for pork and 5 cents per pound for mutton, was $13.40 per acre, or a net profit of $8.40 over and above the cost of seed, preparation of land, planting and drainage.

In the case of lands prone to wash during winter, we find an added argument for winter cover crops in the protection afforded to such land against the damaging action of winter rains.

Of the crops adapted for winter covering, the clovers are to be recommended first, because they not only make a large vegetative growth, but also increase the nitrogen content of the soil. This is done through the agency of bacteria, which develop, under certain conditions, on the roots of such plants. These bacteria are low forms of plant life, so small as to be visible only through the microscope. They form in colonies in the warts or tubercles found on the roots of the clovers and such other plants as peas, beans, vetches, etc. All such plants belong to one family, called legumes, and nitrogen gathering bacteria are not found on the roots of other than leguminous plants. Soils that do not contain the bacteria proper to a given legume must have such bacteria added to them if the crop is to grow to the best advantage. This is called "soil inoculation," and is effected in several ways.

Crops intended for winter cover should be planted early in the fall, so as to produce as large a growth as possible before grazing or plowing under.

SELECTING SEED CORN IN THE FIELD.

One of the easiest ways to increase corn production is by the use of improved seed; and the simplest way to get improved seed is to select one's own seed in the field. As long as we continue to pick out our seed corn from the general supply in the crib, just so long will our yield per acre remain far below what it should be. The principle upon which field selection is based is that "like produces like." If a farmer decides to raise a good milch cow, he selects the calf of a good milker, knowing that, all other conditions being equal, the probabilities are that the better the dam the better will the offspring be. So it is with corn. In other words, before one can say whether a given ear of corn is fit for seed, he must know what kind of mother plant produced that ear. It must not be judged that, because an ear seems good, the plant which produced it was the right sort to breed from, for this plant may have grown under such unusually favorable conditions that the ear is the product of these conditions rather than of the inherent good qualities of the mother plant.

Field selection of seed corn is done when the ears begin to mature—after the husks begin to turn yellow and before the leaves break from the stalk. A good plan is to go through the plot where the best corn is growing, select the stalks from which the seed corn is to be gathered, and mark these stalks with a red rag string. To facilitate this work, it is best not to plant cowpeas or other leguminous crop in the seed plot. If the plot contains two acres, yielding 50 bushels each, and one-tenth of the corn is selected for seed, enough will be obtained to plant 50 acres. The loss of humus on the two acres will be more than offset by the value of the seed corn obtained.

What are the qualities in a stalk of corn, then, that mark it as a fit plant from which to gather seed? Following are the most important points to consider:

a. The stalk should be free of suckers and bear an apparently good ear (in the prolific varieties, two ears); the shucks should extend completely over the tip and cover it tightly; the shank should be rather small and long enough to permit the ear to droop when thoroughly dry; the ears should stand at a height of four to five feet from the ground. The large-stalked, one-eared varieties bear their ears higher than do the prolific varieties.

b. The stalk should not be excessively tall—about 8 feet in the small-eared varieties, and not more than 10 feet in the large-eared types. It should be large at the base, and gradually taper up to the tassel, spindly stalks being always undesirable.

c. The plant should have 12 or more well-developed, broad leaves and a good system of strong brace roots, and should stand upright.

d. No unusually favorable condition should surround the plant, as is the case, for instance, when, on account of a poor stand, the plant stands far apart from others.

Aside from the improvement of seed that follows field selection on the basis outlined above, the quality can be further improved by removing the tassels of the barren and weak stalks. This is done either by cutting or pulling out at the topmost joint the tassels of all such stalks in the seed plot at the time they begin to open up and drop pollen.

At corn-gathering time the seed plot should be gone through and the ear (or best ear) from every marked stalk gathered.

sacked, and stored separately from the general supply. As soon as possible after this, all these ears should be husked, laid on a floor or table, and enough of the best ears selected to supply seed for the crop the year following.

It is well, in this work, first to choose for a type the ear that seems to approach most closely to the ideal which the operator has in mind, and use this ear as a guide. In deciding what ear to select for a type care and intelligence have to be exercised and many points have to be considered. Among these are the following:

The ear should not be excessively large; its circumference should be about three-fourths as great as its length; and should be of the same size throughout its length, rather than tapering. (See Fig. 8, Nos. 1 and 5.) The rows of kernels should not be in pairs and should be straight, twisting neither to right nor left (Fig. 9, Nos. 2 and 3); they should extend in regular order

Fig. 15. Good tips. (Courtesy of the Kansas State Agricultural College.)

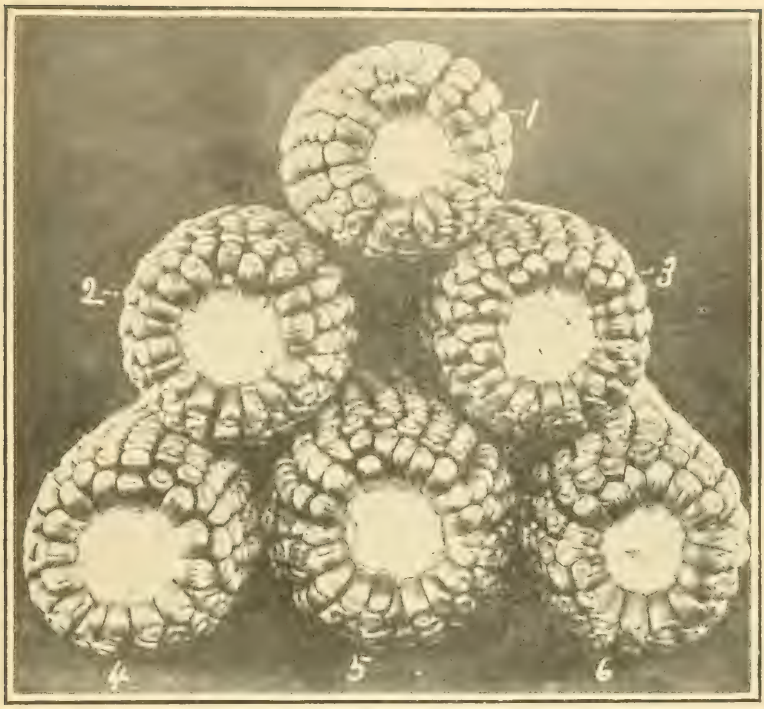

FIG. 16. Good butts. (Courtesy of the Kansas Agricultural College.)

over the butt and tip (Figs. 15 and 16). The butt should be well filled, and should not have a large number of misshapen kernels; the hollow at the butt should be rather deep and not too large; and the general shape of the butt should not be swollen nor so compressed as to indicate a tight and close husk at that point. The tip should be well filled (Fig. 15), and should be neither swollen (Fig. 17, No. 1) nor pointed (Fig. 17, No. 9); it should be relatively free of short, small kernels of flinty appearance. The kernels should not have chaffy crowns (Fig. 19, No. 3) and should be uniform in indentation, color and shape; their shape should be wedged—that is, wider near the crown than toward the tip, so as to allow their filling the entire space around the cob (Fig. 20 and Fig. 19, Nos. 6, 7 and 18). The edges of kernels in consecutive rows should be in close contact throughout their length (Fig. 20, No. 3), and there should be no open space near the cob either between kernels in the same row or kernels in adjoining rows. The furrows between the rows of

kernels on the outside should be very narrow and shallow. (See Fig. 10). In other words, the ear should bear the maximum amount of grain consistent with proper size in cob and kernel. This point can best be determined by grasping the ear firmly in both hands and giving it a twisting motion. Under this test the ear should feel firm under the grasp. In length the kernels should be uniform and should be neither excessively long nor short, a length equal to half the diameter of the cob being desirable. The tips of the kernels should not be chaffy, shrunken, or discolored (Fig. 19, No. 16), as these points indicate lack of vigor and soundness. Extracted kernels should not break off above the tip cap, displaying a black surface at the base of the germs. At the back, the kernels should consist of horny starch well up toward the crown, and should have a clear, healthy appearance. The cob should be neither large (Fig. 20, No. 1) nor small; the former is frequently accompanied by unsound kernels, due to poor drying-out qualities; and the latter does not offer a large enough circumference for the greatest amount of grain. The cob should have a healthy appearance and be free from mould and discoloration. White corn should ordinarily have white cobs, and yellow corn red cobs, although there are several varieties of white corn grown in Louisiana that have red cobs. The foregoing description indicates what the physical

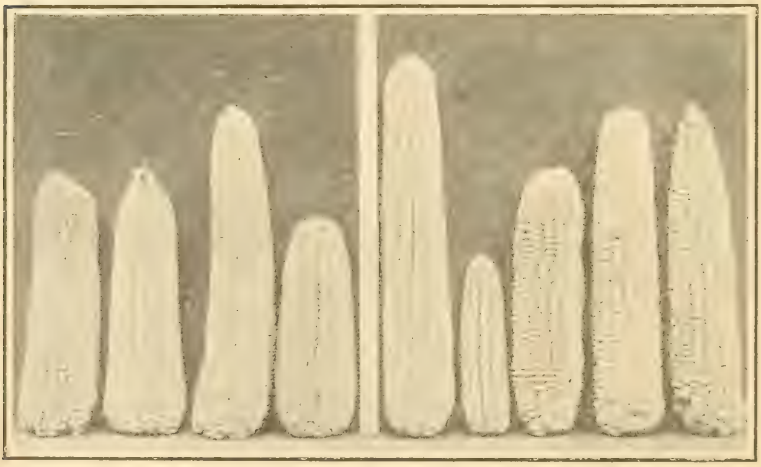

FIG. 17. Defective Ears. (Counting from the left): No. 1, swollen tip. No. 2, swollen butt. No. 3, curved ear. No. 4, ear too short and stumpy. No. 5, ear too long—13 inches. No. 6, ear too short and small. No. 7, poor in all respects. No. 8, ear shows defective pollenation. No. 9, poor butt and tip.

appearance of a good, well-selected seed ear should be; but, unless one's selection has been made in a field of well-bred corn, not all the desirable points enumerated above will be found in any considerable number of ears.

Having selected the type ear, the operator should next choose from the entire supply of field selected ears enough for planting his general crop the following year; and in doing so those ears should be chosen that most closely resemble the type ear, *uniformity in all points being highly desirable.*

At planting time, the small kernels at the tips and the misshapen kernels at the butts should be removed before shelling the corn.

The plot from which the seed corn is to come should receive the greatest care of any part of the corn crop. Just as it is impossible to breed up the best colt from an underfed dam or to rear a prize-winning milch cow from a neglected calf, so the best seed is not produced from corn that grows on a poor and ill-prepared soil, or that has not been properly cultivated, or that has been grown from inferior seed.

CROP ROTATIONS AS AFFECTING YIELDS OF CORN.

One of the best systems of crop rotation among Southern farmers that grow cotton and corn is as follows:

1st year—corn, with peas sown at the last cultivation, and followed by fall-sown oats.

2d year—oats sown in the preceding fall, followed by cowpeas, peanuts, or sweet potatoes.

3d year—cotton, the entire plant to be plowed under (or burned) immediately after the crop has been picked.

The field should be divided into three parts; the corn and peas are planted in one part, followed by oats in the fall; in the second portion of the field, oats are sown (during the previous fall), followed by potatoes or a legume; and in the third part, cotton is grown. The second year, the corn is planted in the second field; the oats in the third; and the cotton in the first. The third year, the corn goes to the third field, the oats to the first; and the cotton to the second; and so on.

Many modifications of this system will suggest themselves to the thinking farmer. Velvet beans may be substituted for

cowpeas the first year; hairy vetch may be sown with the oats; after grazing the oats, lespedeza seed may be sown to follow the oats; and a winter cover crop may be planted in the cotton at the last cultivation.

The advantages of such a system are that two leguminous (or forage), two grain, and one money crop are included in the rotation; that it distributes the farm labor more equally throughout the year; that a clean, cultivated crop (cotton) alternates with leguminous crops; and that the insect and weed enemies which thrive on or are favored by a given crop cannot become permanently established in the field.

Such a rotation system as the one outlined above will largely tend to hold in check such enemies to corn as the white root worm and the corn ear-worm.

ORIGIN OF CORN.

The plant and grain, commonly known as "corn" in America, is properly called *maize,* or Indian corn. Before the discovery of America this grain was unknown to the inhabitants of Europe. When first discovered in Hayti, the local name "mahiz" was adopted. From this word is derived the English *maize,* the French *mais,* and the Latin *mays.* The botanical name of the plant is *Zea Mays* and it belongs to the grass family. In Europe, all grains or cereals are properly called corn, and there our maize is known as Indian corn, a name of obvious origin.

The corn plant has never been found growing in the wild state, and it is supposed to have grown first in Mexico and Central America. From there it had spread, at the time Columbus discovered America, into South America and northward into certain sections now included in the territory of the United States.

In The Book of Corn (Orange Judd Co., New York City) Dr. Hexamer says: "A most remarkable proof of the antiquity of corn has been discovered by Darwin. He found ears of Indian corn * * * buried in the soil of the shore in Peru, now at least eighty-five feet above the level of the sea. The Smithsonian Institution at Washington has an ear of corn found deposited in an earthen vessel eleven feet underground, in a grave with a mummy near Ariquepe in Peru."

CLASSIFICATION OF CORN.

According to Dr. E. L. Sturtevant, there are six different kinds (species) of corn, each of which is subdivided into varieties. The six species are the dent, flint, soft, sugar, pod and pop. Following is a brief description of each species:

Dent corn *(Zea indentata)* is the most common of all corn, and is the kind grown generally over the South and the corn belt. Its distinguishing mark is the dent in the crown of the kernel, caused by a shrinking of the kernel as it matures. The depth and form of indentation vary with the different varieties, of which more than 300 have been described.

Flint corn *(Zea indurata)* has short kernels with smooth rounded crowns, free of indentation. It contains less soft starch and more horny starch than dent corn does; and, hence, the kernels of flint varieties have a clear (translucent) appearance and are harder than those of the dent varieties. Yellow Creole is our commonest flint corn.

Soft corn *(Zea amylacea)* also has smooth-crowned kernels; but these contain no hard, horny starch. It is a softer corn than the dent varieties, and is not extensively grown in the State. Brazilian flour corn (Fig. 9, No. 8) is probably the only variety produced in Louisiana.

Sugar corn *(Zea saccharata)*, also called sweet corn, is grown in Louisiana mainly for table use and in Maine and other states for canning purposes. When mature, its kernels are wrinkled and translucent, and they are sweet to the taste. Fifty or more varieties are known.

Pod corn *(Zea tunicata)* is distinguished from other species by the small husk or pod that completely envelops each separate kernel (Fig. 9, No. 9). It is grown mainly as a curiosity, and is supposed to be the original type of corn, from which others have been developed.

Popcorn *(Zea everta)* is a small-kerneled flinty species, which pops when sufficiently heated. The popping is due to an explosion of the horny starch (endosperm) of the kernel. Red, yellow and white varieties of popcorn are grown. The chief varieties, of which there are a score or more, are the white pearl, queens, golden, silver lace, and several species of rice, characterized by sharp-pointed kernels.

A STUDY OF THE KERNEL AND PLANT OF CORN.

The corn kernel consists of several distinct parts, as follows: the tip-cap, by which the kernel is attached to the cob; the seed coat or hull, which can be readily taken off by soaking the kernel in warm water; the germ, which is the sunken part on the side of the kernel and which contains the undeveloped corn plant; the soft starch found about the crown and tip; the horny starch, mainly found along the sides and lower half of the body of the

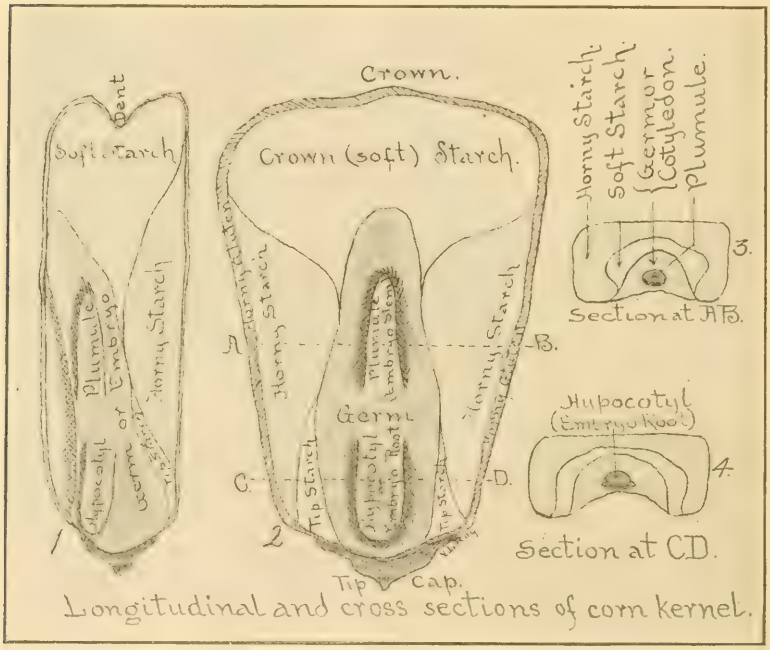

FIG. 18. Diagram of a corn kernel in sections.

kernel; and the horny gluten which covers the starchy portion of the kernel and lies under the hull. (See Fig. 18.)

Within the germ the undeveloped (embryonic) stalk and root are contained. By cutting the kernel crosswise at the middle and lower quarter, these two parts may be pulled out whole (Fig. 18, Nos. 3 and 4). When the kernel is placed in a warm, moist place, the embryo stem and root begin to grow and burst through

the seed coat, the former always growing upward and the latter downward.

As soon as the rootlet grows out into the soil, it puts out a great many root hairs. It is through these root hairs that the plant takes in food and water from the soil. When a plant is pulled from the ground, the root hairs are torn off; but if kernels are sprouted in clean sand or between folds of flannel, these root hairs are readily seen.

As the small stem grows upward and the stalk begins to form, the plant produces several short joints or nodes which are found between the seed kernel and the surface of the soil. Each of these joints bears a leaf, and also throws out a set or whorl of roots. The number of roots formed increases at each successive joint, and as many as ten whorls may be thrown out from that part of the stalk which is in the ground.

From the joints that form above, but near, the ground roots are also thrown out. These are called brace roots. They are thick and strong, and their use is to assist in keeping the plant upright when it sets the ear and becomes, so to speak, top-heavy.

That part of the leaf which surrounds the stalk is known as the sheath. Under the sheath of each leaf there is, on the groove side of the stalk, a bud which may develop into an ear or sucker. In the large-eared varieties, only one of these develops into an ear, but in the prolific varieties two or more grow into mature ears. In certain varieties of prolific corn as many as five, and occasionally eight, ears are formed. In such cases the size of the ears is necessarily reduced.

When studying the corn plant, note the collar of hairs or bristles where the blade of the leaf joins the sheath. The purpose of this is to throw off the water that would lodge between the sheath and the stalk.

The corn plant has two kinds of flowers: the tassel, which is the male flowers; and the silks and undeveloped seed, which constitute the female flowers. Each silk is attached at the cob end to a small round body (ovule), which is capable of developing into a kernel.

When a grain of pollen falls on the silk, the ovule begins to develop into a seed. In order that each silk may be reached by one or more pollen grains, nature has provided that each tassel shall produce an abundance of pollen, as many as 18,000,000

FIG. 19. Kernels of different varieties of corn, illustrating good and bad points. See explanation, page 43.

grains being formed in a well-developed tassel. The scarcity of pollen during rainy spells or when only a few plants are grown together, accounts for the undeveloped ears and nubbins formed under those conditions. Whenever a silk fails to receive pollen, the female flower fails to develop and no seed is formed (Fig. 17, No. 8).

The pollen of corn, being so light and abundant, is readily carried by the wind to long distances. This is the reason why corn crosses so easily. In order to keep a variety of corn from crossing with those in neighboring fields, they must be planted at a distance of 800 to 1000 feet apart.

EXPLANATION OF FIG. 19.—No. 1, Square Deal. No. 2, Hickory King. No. 3, Strawberry Shoepeg. No. 4, White Shoepeg. No. 5, White Flint. No. 6,, Gilmer Yellow Dent. No. 7, Leaming. No. 8, Yellow Creole, kernels short and of poor shape. No. 9, Yellow Creole, kernels of good shape and length. No. 10, Munson. No. 11, Gandy. No. 12, Shaw. No. 13, Royal Semiflint. No. 14, Mosby. No. 15, Stewart White Dent. No. 16, shrunken tips showing poor vitality. No. 17, poor shape; curved sides cause open furrows and lost space. No. 18, kernels of fair shape. Compare size of germs in Nos. 3 and 6, 14 and 7.

LENGTH AND SHAPE OF CORN KERNELS.

The length and shape of corn kernels vary with different varieties, but for each variety they should be more or less fixed (Fig. 19). The ideal shape for kernels is that of a wedge, which shows the kernels to fill the entire space about the cob. For certain standard varieties grown at the North, it is considered desirable that kernels should be twice as wide as they are thick, and twice as long as they are wide. (Compare Nos. 2, 4, 5, 8, 16 and 18 in Fig. 19.) Lengths varying from five-eighths to three-fourths of an inch are preferable. Kernels that are half as long as the diameter of the cob may generally be considered very satisfactory in length (Fig. 20, No. 2).

For seed purposes, it is best to select ears with kernels that have well-developed and healthy germs (hearts). (Examine germs as shown in Fig. 19.) Kernels with shrunken or discolored germs should be avoided. Prominent shoulders at the tip end of the kernel indicate vigor (Fig. 19, Nos. 1, 4, 18); long, shrunken, chaffy tips indicate the reverse.

Other considerations being equal, the longer the kernels of an ear, the larger the weight of shelled corn it yields. (Compare Nos. 1, 2 and 3 in Fig. 20.) This is a point worthy of

more attention than it has heretofore received in Louisiana. Small or slender ears can not be expected to have as long kernels as larger ears; and the kernels of the flint varieties are uniformly shorter than those of the dent corns (See Fig. 19). Length of kernels in a given variety is related to its indentation, in that smooth ears with shallow dents generally have shorter kernels. Ears with pinched, chaffy crowns and deep dents show longer kernels than do smooth-crowned ears. (Compare Nos. 1, 3, 4, 15 and 18 in Fig. 19 with other kernels.)

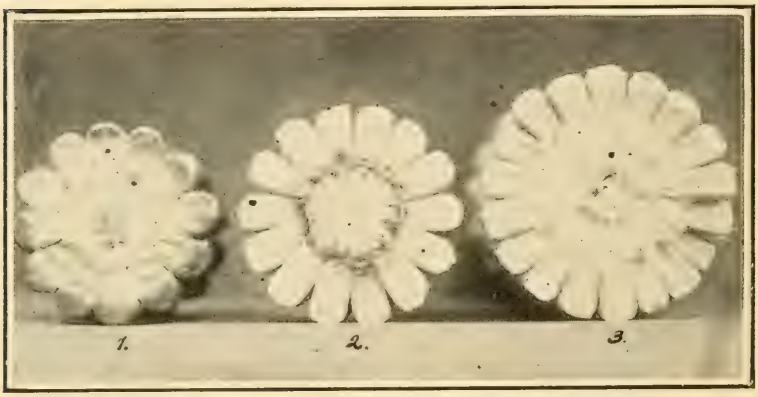

FIG. 20. Cross sections of ears. No. 1, Yellow Creole, kernels short, furrows open, cob too large. No. 2, Square Deal, long, kernels, cob small. No. 3, Shaw, compact, wedge-shaped kernels.

The longest-kerneled varieties in Louisiana are the Square Deal and the Shoepeg (Fig. 19). The prolific varieties—Gandy, Mosby, Hastings, etc.—generally have kernels that are rather short; and the shortness of the kernel in Yellow Creole constitutes perhaps the chief objection to that variety in its present condition of breeding in Louisiana. By selection, the length of kernel of this variety could no doubt be easily increased to one-half inch, and the diameter of the cob reduced at the same time. The flintiness of the variety, making it practically proof against weevils, and the heaviness of its grain (See Fig. 25), are points greatly in favor of Yellow Creole corn. Certain varieties have kernels that are undesirably slender. Such are certain strains of the Shoepeg and the Semiflint (Fig. 19, Nos. 3, 4 and 15). Varieties producing kernels with curved or angular sides (Fig.

19, No. 17) are objectionable on account of the wide furrows found between the rows, either at the tip or crown ends of the kernels

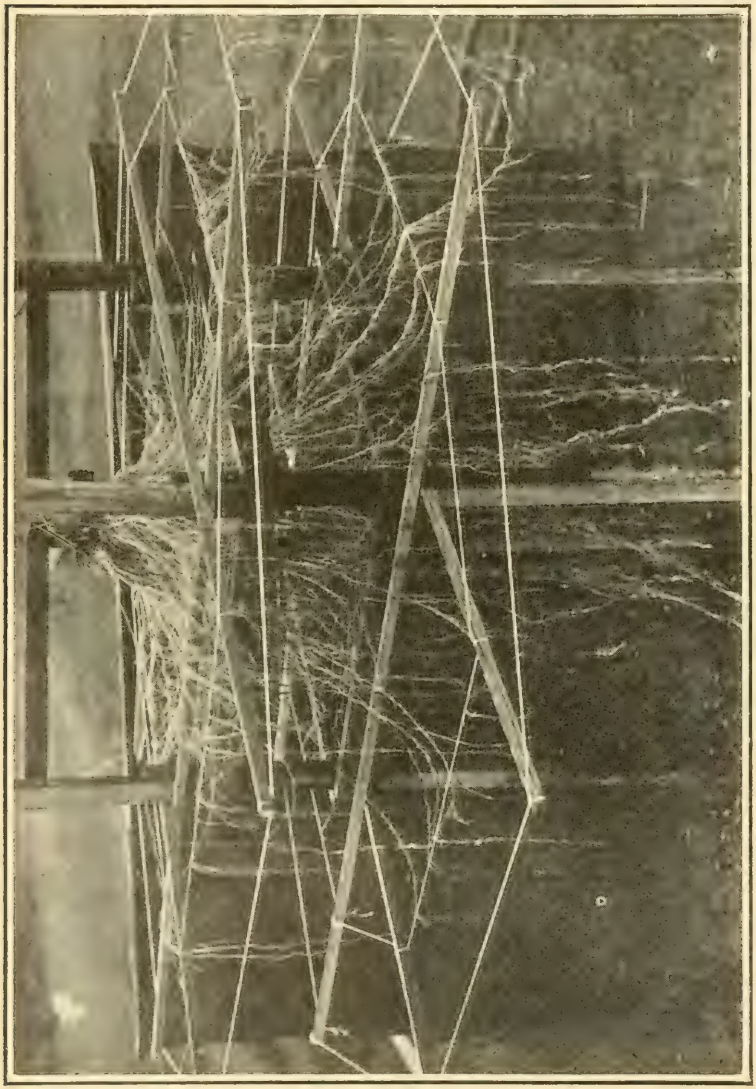

FIG. 21. Root system of a corn plant in tassel. The height of this figure represents four feet. (Courtesy of the Illinois College of Agriculture.)

THE ROOT SYSTEM OF CORN.

In order to understand how the corn crop should be cultivated, it is important to know something of the root system of the plant—the amount of roots, their lengths, the depth to which they penetrate the soil, and their nearness to the surface. Such a knowledge enables the farmer to cultivate his crop intelligently under the varying conditions of actual practice. Yet, it is probable that less is known by the farmer of the roots of corn than of any other part of the plant.

Unlike cotton and many other plants, corn has no tap root. The first root thrown out by corn becomes aborted, and others develop, penetrating the soil in all directions and forming what is known as a fibrous system of roots. The brace roots, which put out from the lower joints (nodes) of the corn stalk, are adventitious roots, and their work is chiefly to anchor the plant more firmly to the soil.

It has been estimated that a fully grown corn plant may have a total length of roots exceeding one mile (Fig. 21). The aggregate length of the roots of a corn plant grown in an earthen jar, measured forty-five days after sprouting, was found to be 353 feet. To show the surprising amount of roots produced by corn, a plant should be grown in a box or flower pot filled with a mixture of equal parts of sand and well-rotted manure. At the proper time, the contents of the box or pot should be carefully taken out and the soil washed away from the roots of the plant.

Several of the experiment stations have made studies of the root system of corn. The Wisconsin Station found that the roots of corn plants 18 inches tall growing 3½ feet apart met and passed one another in the middle of the rows; and that when the corn was about three feet high, the entire upper two feet of the soil was occupied by roots. At the North Dakota Station it was found that when the plants were 4½ feet high, feeders were often sent to within two inches of the surface. Investigations made at the Minnesota Station show that the early roots of corn, put out in the spring, grow nearly horizontally. (See Fig. 21 and Fig. 22.)

These investigations confirm the observations of farmers to the effect that deep cultivation of corn is ill-aadvised under ordi-

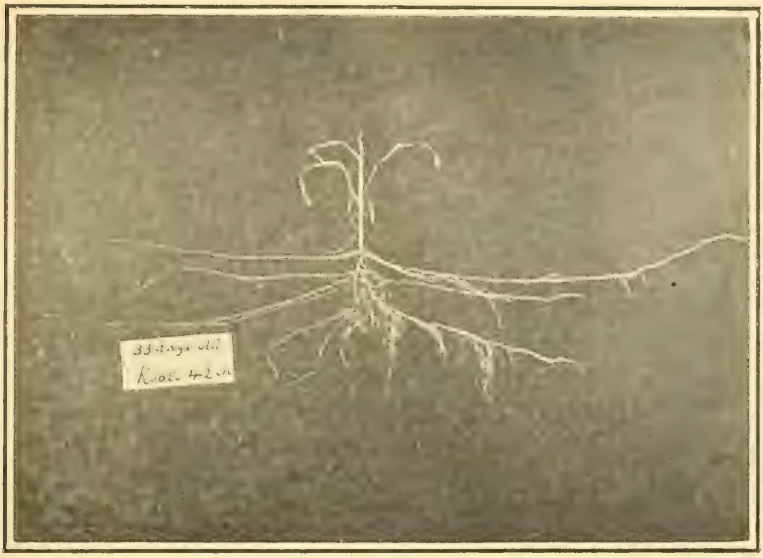

FIG. 22. Corn plant, showing roots 42 inches long 33 days after planting.

FIG. 23. Showing amount and fibrous nature of corn roots.

These cuts are from photographs kindly furnished by a Mississippi county superintendent.

nary conditions, and that the turning plow or other implement that tills the soil to a depth of four or five inches has no place in the cultivation of corn. The masses of roots so frequently torn away from the corn plant and dragged to the end of the rows when the plow is used as a cultivator, are evidences of the damage resulting from such cultivation.

It has been repeatedly shown that, under favorable conditions, corn roots penetrate the soil to a depth of four feet. (See Fig. 21.) As it is impossible for corn roots to extend and live below the level of the water table, this shows the importance of draining corn land thoroughly and at all times keeping the upper four feet of soil from becoming saturated with water for any length of time

COMPOSITION OF CORN.

The corn kernel is composed of several different ingredients. These are divided into nitrogenous and non-nitrogenous material. The former is composed of those substances in the kernel that contain nitrogen, and is termed protein. The non-nitrogenous material consists of water, ash, fat, crude fiber, and a class of substances which includes starch, sugar, gum, etc., and which the chemist calls nitrogen-free extract.

Water is found in corn, as it is, indeed, in all feeds, no matter how dry they may seem to be. Thoroughly dry corn contains about 11 per cent of moisture; and when not fully mature and dry, it may contain twice this proportion of moisture.

The *starch,* sugar and gum found in corn are called carbohydrates because they contain carbon, hydrogen and oxygen in certain ratios. The animal body utilizes the carbohydrates of corn and other feeds, first, to develop bodily heat and energy, and, secondly, to produce animal fat. Average dry corn contains about 70 per cent of carbohydrates, the most of which is starch.

The *fat* of the corn kernel makes up about 5 per cent of its weight. This fat, when separated from the remaining ingredients of corn, is known as corn oil, and is used by paint, soap and rubber manufacturers. The animal body uses the fat of corn in the same way and for the same purposes that it does the starch.

Protein is relatively the most valuable ingredient of the

corn kernel. It is used by the animal in building up the body—skin, muscles, tendons, organs, hair, horns, hoofs, etc., and in restoring waste tissues. On an average, corn contains about 10.5 per cent of protein; but by selection it has been found possible to increase this percentage considerably.

The *ash* of a plant is the mineral residue obtained when it is burned completely. Corn grain contains 1.5 per cent of ash. This constituent of the corn kernel goes to build the bony structure of the animal.

The *fiber* in the corn kernel is found chiefly in the hull. It composes about 2 per cent of the corn kernel. It is less digestible than starch, although, like the latter, it is a carbohydrate.

The composition of the dent and flint varieties of corn varies only to a slight extent. This is shown by the following data, taken from Jordan's The Feeding of Animals:

COMPOSITION OF DENT AND FLINT CORN.
(Expressed in per cents.)

	Water	Ash	Protein	Fiber	Starch, etc.	Fat
Dent Corn	10.6	1.5	10.3	2.2	70.4	5.0
Flint Corn	11.3	1.4	10.5	1.7	70.1	5.0

Although the digestibility of flint corn does not seem to have been determined by experiment, it is reasonable to assume that, if it differs from that of dent corn at all, such difference is in the direction of a lower digestion-coefficient for the flint corn. And, if this assumption is correct, there appears to be no ground for the belief, found among some farmers, that flint corn has a higher feeding value than the dent varieties.

BUYING SEED CORN IN THE EAR.

Corn bought for planting purposes should be purchased only from reliable seedsmen and corn breeders; for, while the cost of seed bought from trustworthy dealers and breeders is usually higher than that sold by unreliable firms, its better qualities

justify the price. Particularly is it important to deal with responsible persons when buying seed corn shelled rather than in the ear.

The practice, however, of buying shelled corn for planting purposes cannot be recommended. It is true that seed corn sold in the ear always commands a higher price than the same corn shelled; but, if a variety or strain of corn is really worth buying for seed, the farmer cannot afford to buy it in such form that it is impossible to tell whether he is getting what he pays for or not. Only when in the ear does corn reveal all the qualities or points upon the basis of which it should always be bought. The farmer will, for instance, believe that he is buying corn from ears 9 inches long and having small cobs, when, in fact, he may get the grain from large-cobbed, 7-inch ears, if he buys his seed corn shelled. Besides, the tip and butt kernels of seed ears should always be discarded, and few seedsmen may be depended upon to observe this rule.

Seed corn in the ear should probably be shipped in tight wooden boxes, rather than in open crates, provided the corn is not to remain boxed longer than a few days. This protects the corn from the attacks of mice and rats while in transit or in depots.

GERMINATION TEST FOR CORN.

One of the easiest, cheapest and most effective means of increasing the production of corn is by the use of seed having strong vitality. Often the seed corn used contains a large proportion of kernels that do not sprout or that, having sprouted, show little life or vitality and fail to produce an ear. This is the case more frequently in the northern states, where the growing season is short and the seed may not mature fully; but in the South also much corn used for seed has a poor vitality due to careless method in storing and poor breeding. Ordinarily, it may be said that, in the South, good sound ears gathered after full maturity give seed that makes a good growth.

The points of a healthy and virile seed ear are the following:

a. The cob should have a clear, healthy color, and be free of mould.

b. The ear should possess a sound appearance, and be free of weevils and moths.

c. The kernels should give evidence of thorough maturity and have a clean, healthy look; the tips of the kernels should not be shrunken; the germs should be strong in appearance and free of discoloration; and the shoulders of the kernels next to the tip should be rather prominent.

The best way to determine whether an ear of corn has enough vitality for use as seed is by the germination test, which is made as follows:

A wooden box is made of one-half inch lumber with inside measurements 3 inches deep, 12 inches wide, and 18 inches long (Fig. 24). A line is marked around the box, one-half inch from the upper edge. At this line, gimlet holes are made on all four sides one and one-half inches apart, the first and last holes on each side being one and one-half inches from inside corners. Through these holes a soft wire is strung tightly, lacing it by drawing the cross wires above and under alternate wires running lengthwise. This gives 96 squares with one and one-

FIG. 24. Corn germinator with kernels in place, ready for germination test.

half-inch sides. These squares should be numbered as follows: mark one corner A; running from this corner down the width of the box, mark the squares 1, 13, 25, 37, 49, 61, 73, 85. Each long row has 12 squares, and the numbers written at the end of the box are the numbers of the first square in each row. The number of a square in the middle of the box can be ascertained by counting up from the number given at the beginning of the row in which the square stands. The box should now be filled with clean, moist sand level with the wire. The germinator is now ready to receive the seed.

Assuming that there are 96 ears to be tested, each ear is numbered. With a penknife five kernels are then extracted from each ear. This is done by drawing a kernel one-third the distance from the butt to the tip; the ear is then given a quarter turn, and the next kernel is drawn from the middle of the ear; another quarter turn in the same direction as before, and another kernel is taken a third the distance from the tip; the fourth kernel is drawn in the same row as the third but near the butt; and the fifth kernel is taken opposite to the second. These five kernels are then placed in the square corresponding to the number of the ear, with germs down, and are pressed into the sand to a depth of one-half inch. They are next covered with moist sand, and a layer of several thicknesses of old flannel cloth is carefully spread over the sand. The cloth should be thoroughly moist before using, and should be covered over with sufficient sand to fill the box to the upper edge.

The box should then be placed on a shelf in the kitchen or other place where it is cool at night and warm in the day time. This makes the conditions for germination about the same as in the field. As soon as the corn begins to sprout under the cloth, it and the sand above should be removed. If the sand dries out during the process, it should be sprinkled over with water, so as to keep it moist.

Three or four days after the corn comes up, each set of kernels should be carefully examined. If all five kernels have put out vigorous, well-developed sprouts, and the roots are strong and healthy, the ear from which they come is suitable for plant-

ing; but, if one or more kernels fail to sprout or put out a weak shoot, the corresponding ear should be thrown out as unfit for seed.

SELLING CORN BY WEIGHT.

Corn is ordinarily sold in Louisiana by the barrel (flour). In some parishes the barrel is filled with corn in the shuck; in others, husked corn is used; while in certain other sections, a barrel means two barrels in the husk. The result is confusion and inaccuracy. The farmer who sells a barrel of corn in the husk does not know whether he has sold a bushel (56 pounds) or more. Certain varieties of corn shell out considerably more than 56 pounds to the barrel.

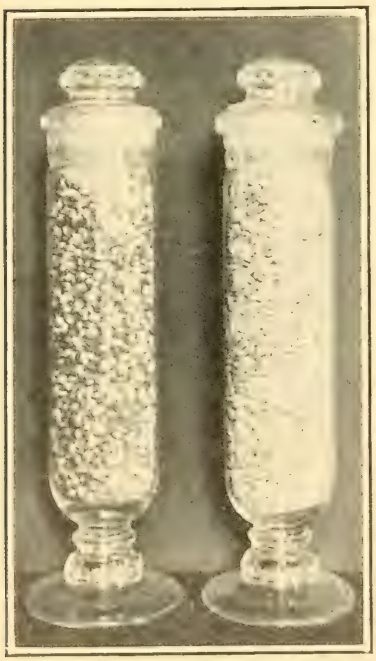

FIG. 25. Cylinder on the left contains 44 oz. of Yellow Creole corn; equal volume of White Dent on right contains 40 oz.

Even the measurement of corn by the use of the bushel measure is inaccurate. This is clearly shown in Fig. 25, where the two cylinders contain equal measures of corn; but, the Yellow Creole corn in the left-hand cylinder weighs 44 ounces, and the white dent in the one on the right weighs only 40 ounces. This shows that the former, volume for volume, is 10 per cent heavier than the latter. Hence if a bushel measure of this white dent weighs 56 pounds, a bushel of the former will weigh approximately 62 pounds.

Another reason for selling corn in the grain by weight is found in the rapid growth of the export trade in this cereal in Louisiana. Foreign markets

demand shelled corn, and not corn in the ear. The installation of corn shellers in every locality where any considerable amount of corn is sold for export is to be commended.

INSECT ENEMIES OF CORN.

The plant and ear of corn are subject to the attacks of many diseases and pests. More than two hundred insects are said to be injurious to corn. The chief insect enemies of corn in Louisiana today are the wireworms, white grub, southern corn root worm, cutworm, larger and smaller cornstalk borers, the corn ear (or cotton boll) worm, and the corn root louse (aphis), all of which attack the corn plant; and the grain moth and corn weevil, which attack the stored grain.

Under the subject "Storing Corn," page 30, a method has been described for destroying insects in stored corn. Space will not permit a discussion of the best methods of contending with all the other insect enemies of corn. In general, however, it may be said that fall plowing, winter harrowing, rotation of crops, cleaning turn rows, burning underbrush and other hiding places, and clean cultivation, are safe and profitable methods of contending with the field enemies of corn.

Blackbirds and crows frequently rob the corn land of its seed corn before or soon after it sprouts. The use of tar in coating the seed before planting is recommended by some farmers; but this is a practice of very doubtful value. Other farmers have been driven to the use of the shotgun in ridding their corn fields of these birds.

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